

REMARKS

The specification has been amended to avoid the possibility of confusing the discovery made by the inventors in conjunction with the invention with what was known in the prior art.

Claims 1 and 6 have been amended to more definitively recite the claimed invention.

Claims 1-6 remain pending in the application.

Reconsideration and examination of Claims 1-6 in view of the arguments below is respectfully requested.

By way of this response, Applicant has made a diligent effort to place the claims in condition for allowance. However, should there remain any outstanding issues that require adverse action, it is respectfully requested that the examiner telephone John Chen at (408)433-6446 so that such issues may be resolved as expeditiously as possible.

RESPONSE TO THE REJECTION OF CLAIMS 1, 4 AND 5

Claims 1, 4 and 5 stand finally rejected under 35 U.S.C. § 103(a) as being unpatentable over Doke, U.S. Patent No. 5,367,890 (Doke). The amendment of Claim 1 overcomes the rejection as follows.

Claims 1, 4 and 5 encompass a thermal profiling device for a flip-chip integrated circuit. Specifically, Claims 1, 4 and 5 recite a packaging substrate of a flip-chip integrated circuit and a semiconductor die of a flip-chip integrated circuit. The semiconductor die has an active circuit surface for interconnecting the semiconductor die to the packaging substrate. The active circuit surface of the semiconductor die is secured to an upper surface of the

packaging substrate, and a thermocouple is secured directly to the active circuit surface of the semiconductor die for measuring a temperature of the active circuit surface of the semiconductor die during a reflow process.

Doke discloses a thermoelectric device for transferring heat between a cold plate (36) and a hot plate (38) by an array of thermocouples connected therebetween. Doke does not teach or suggest the claimed packaging substrate of a flip-chip integrated circuit, nor does Doke teach or suggest the claimed semiconductor die of a flip-chip integrated circuit, nor does Doke teach or suggest the claimed active circuit surface of the semiconductor die for interconnecting the semiconductor die to the packaging substrate, nor does Doke teach or suggest the claimed thermocouple secured to the active circuit surface of the semiconductor die for measuring a temperature of the active circuit surface of the semiconductor die during a reflow process. Not only does Doke lack a teaching or suggestion of measuring a temperature of the active circuit surface of the semiconductor die during a reflow process, but also modifying Doke by placing thermocouple pairs (60) between the semiconductor dies (14, 16, 18, and 20) and either the hot plate (38) or the cold plate (36) instead of between the hot plate (38) and the cold plate (36) as shown would decouple the thermocouple pairs (60) from the opposite plate, rendering Doke unsatisfactory for its intended purpose. No motivation therefore exists in the prior art to modify Doke to arrive at the claimed invention. Because no motivation exists in the prior art to modify Doke to arrive at the claimed invention, Claim 1 is not obvious under 35 U.S.C. § 103(a).

RESPONSE TO THE REJECTION OF CLAIM 6

Claim 6 stands finally rejected under 35 U.S.C. § 103(a) as being unpatentable over Doke and further in view of Lemoine et al., U.S. Patent No. 5,585,577 (Lemoine). The amendment of Claim 1 overcomes the rejection as follows.

Neither Doke nor Lemoine teaches or suggests the claimed packaging substrate of a flip-chip integrated circuit, nor does either teach or suggest the claimed semiconductor die of a flip-chip integrated circuit, nor does either teach or suggest the claimed active circuit surface of the semiconductor die for interconnecting the semiconductor die to the packaging substrate, nor does either teach or suggest the claimed thermocouple secured directly to the active circuit surface of the semiconductor die for measuring a temperature of the active circuit surface during a reflow process. Not only does Doke lack a teaching or suggestion of measuring a temperature of a flip-chip integrated circuit during a reflow process, but also no motivation exists in the prior art to modify Doke with Lemoine to arrive at the claimed invention as explained above.

Because neither Doke nor Lemoine teach or suggest the claimed thermocouple secured directly to the claimed active surface of the semiconductor die of a flip-chip integrated circuit for measuring a temperature of the active circuit surface of the semiconductor die during a reflow process, and because there is no motivation in the prior art to modify Doke to arrive at the claimed invention, Claim 6 is not obvious under 35 U.S.C. § 103(a).

RESPONSE TO THE REJECTION OF CLAIMS 2 AND 3

Claims 2 and 3 stand finally rejected under 35 U.S.C. § 103(a) as being unpatentable over Doke as applied to

Claim 1 and further in view of Hayes, U.S. Patent No. 5,681,757 (Hayes). The amendment of Claim 1 overcomes the rejection as explained above.

Because neither Doke nor Hayes teach or suggest the claimed thermocouple secured directly to the claimed active surface of the semiconductor die for measuring a temperature of the active circuit surface of the semiconductor die during a reflow process, and because there is no motivation shown in the prior art to modify Doke with Hayes to arrive at the claimed invention, Claims 2 and 3 are not obvious under 35 U.S.C. § 103(a).

Conclusion

In summary, the rejection of Claims 1-6 is overcome by the amendment. Because Doke does not teach or suggest the claimed device for measuring the temperature of an active circuit surface of a semiconductor die of a flip-chip integrated circuit during a reflow process, and because there is no motivation shown in the prior art to modify Doke to arrive at the claimed invention, and because such a modification would render Doke unsatisfactory for its intended purpose, Claims 1-6 are not obvious under 35 U.S.C. § 103(a).

The fee for a Request for Continued Examination is attached to this amendment.

In view of the above, Applicant submits that Claims 1-6 are in condition for allowance, and prompt and favorable action is earnestly solicited.

Respectfully submitted,



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DOCKET NO. 99-099
65611

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

The following changes have been made to the pending claims:

1.(amended) A thermal profiling device for a flip-chip integrated circuit comprising:

a packaging substrate of a flip-chip integrated circuit ~~[having an upper surface]~~;

a semiconductor die of the flip-chip integrated circuit having an active circuit surface for interconnecting the semiconductor die to the packaging substrate wherein the active circuit surface is secured directly to the upper surface of the packaging substrate; and

a thermocouple secured directly to an [the] active circuit surface of the semiconductor die for measuring a temperature of the active circuit surface of the semiconductor die during a reflow process.

6.(amended) A thermal profiling device comprising:

a packaging substrate of a flip-chip integrated circuit having a first surface and a second opposite surface;

an opening passing through the second opposite surface and through the first surface of the packaging substrate;

a semiconductor die of the flip-chip integrated circuit having an active circuit surface for interconnecting the semiconductor die to the packaging substrate wherein the active circuit surface is secured directly to the first surface of the packaging substrate; and

a thermocouple secured directly to the active circuit surface of the semiconductor die through the opening for measuring a temperature of the active circuit surface of the

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semiconductor die during a reflow process [~~positioned inside
the opening and secured directly to the active circuit surface
of the semiconductor die~~].